Claims

We claim:

1. An integrated circuit device comprising:

a ferroelectric material positioned between first and second metal electrodes; and

a passivation layer positioned on said first electrode, said passivation layer comprising Titanium doped Aluminum Oxide.

2. The device of claim 1 wherein said passivation layer has a thickness of at least 200 Angstroms.

3. The device of claim 1 wherein said first electrode comprises Platinum.

4. The device of claim 1 wherein said ferroelectric material comprises SBT.

5. The device of claim 1 wherein said passivation layer remains adhered to said first electrode after being annealed in an oxygen ambient at a temperature greater than 300 degrees Celsius for at least one minute.

6. The device of claim 1 wherein said passivation layer remains adhered to said first electrode after being annealed in a forming gas ambient at a temperature of at least 400 degrees Celsius for at least five minutes.

7. The device of claim 6 wherein said metal electrode-ferroelectric-metal electrode structure defines a first polarization hysteresis loop before being annealed in a forming gas ambient at a temperature of at least 400 degrees Celsius for a time period of at least five minutes, and defines a second polarization hysteresis loop after being annealed in a forming gas ambient at a temperature of at least 400 degrees Celsius for a time period of at least five minutes, and wherein a polarization of said first polarization hysteresis loop is within twenty percent of a polarization of said second polarization hysteresis loop.

8. The device of claim 1 wherein said integrated circuit device is chosen from the group consisting of: a nonvolatile memory device, a FeRAM, a DRAM, a capacitor, a pyroelectric infrared sensor, an optical display, an optical switch, a piezoelectric transducer, and a surface acoustic wave device.

9. The device of claim 1 wherein said second electrode comprises Iridium, Tantalum and Oxygen.

10. The device of claim 1 wherein said passivation layer comprises at most a 15% Titanium doping.

11. A method of manufacturing an integrated circuit device including a ferroelectric structure having a passivation layer, comprising the steps of:

providing a deposition chamber;

providing in said deposition chamber a ferroelectric structure including a ferroelectric material positioned between top and bottom electrodes;

providing Aluminum and Titanium in said deposition chamber; and

sputtering said Aluminum and said Titanium so as to form a Titanium doped Aluminum Oxide passivation layer on said top electrode.

12. The method of claim 11 wherein the step of providing said Aluminum and said Titanium comprises providing an Aluminum target and a Titanium target each powered in a range of 10W to 800W, and wherein a ratio of the power on the Aluminum target to the power on the Titanium target is in a range of 10:1 to 3:1.

13. The method of claim 11 wherein said Titanium doped Aluminum Oxide passivation layer comprises an atomic percentage of Titanium in a range of 1% to 30%.

14. The method of claim 11 wherein said deposition chamber further comprises a shutter movable between an open position so as to allow deposition on said ferroelectric structure and a closed position so as to allow sputtering of said Aluminum and Titanium, wherein said step of sputtering said Aluminum and Titanium comprises sputtering said Aluminum and Titanium in an ambient containing Argon for a time period in a range of thirty seconds to ten minutes with said shutter in said closed position.

15. The method of claim 14 further comprising the steps of providing Argon and Oxygen to said deposition chamber wherein a ratio of the Argon to the Oxygen is in a range of 10/1 to 10/10, and wherein said step of sputtering said Aluminum and Titanium comprises sputtering said Aluminum and Titanium for a time period in a range of ten seconds to five minutes with said shutter in an open position so that said passivation layer is deposited on the ferroelectric structure.

16. The method of claim 15 further comprising the steps of providing Argon and Oxygen to said deposition chamber wherein a ratio of the Argon to the Oxygen is in a range of 10/8 to 10/20, retaining said shutter in said open position, and powering said Aluminum and Titanium for a time period in a range of one minute to thirty minutes.

17. The method of claim 16 further comprising the steps of reducing an Oxygen supply to said deposition chamber such that a ratio of the Argon to the Oxygen is in a range of 10/1 to 10/10, moving said shutter to said closed position, removing said Oxygen supply, and continuing to sputter said Aluminum and Titanium in an Argon ambient for a time period in a range of thirty seconds to ten minutes.

18. The method of claim 17 wherein the Titanium doped Aluminum Oxide passivation layer that is formed has a thickness in a range of 50 to 500 Angstroms.

19. The method of claim 17 further comprising repeating the steps of claims 15, 16 and 17 until a desired thickness of said passivation layer is achieved.

20. The method of claim 15 wherein said Aluminum and Titanium comprise a single target manufactured of an Aluminum Titanium alloy having a Titanium composition in a range of one to thirty percent, and wherein said step of sputtering said Aluminum and Titanium comprises DC sputtering said single target in an Oxygen ambient.

21. The method of claim 15 wherein said Aluminum and Titanium comprise a single target manufactured of an Aluminum Titanium Oxygen alloy, and wherein said step of sputtering said Aluminum and Titanium comprises RF sputtering said single target in an Argon and Oxygen ambient, wherein an Argon/Oxygen ratio of said Argon and Oxygen ambient is in a range of 1/10 to 10/1.

22. The method of claim 17 wherein the steps of claims 15, 16 and 17 are carried out at a pressure in a range of 1 mTorr to 20 mTorr.

23. The method of claim 11 further comprising the step of annealing said Titanium doped Aluminum Oxide passivation layer in an Oxygen atmosphere at a temperature in a range of 400 to 800 degrees Celsius for a time period in a range of ten seconds to one hour.

24. An integrated circuit device including a ferroelectric structure having a Titanium doped Aluminum Oxide passivation layer, wherein said integrated circuit device is manufactured by the method of claim 11.